Using the Technology Acceptance Model to Predict Website Usage: Extensions and Empirical Tests

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SERIE **RESEARCH MEMORANDA**

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Abstract

Many organisations today are trying to increase the number of visits to their website, as well as the frequency and duration of their visits once they get there. In this paper, we empirically investigate an extension of the Technology Acceptance Model (TAM, originally developed by Davis, 1989) to explain the individual acceptance and usage of a website. The project extends TAM with two "website" constructs: "perceived entertainment value" and "perceived presentation attractiveness".

To validate our model, we partnered with a Dutch portal site, that had over 300 000 subscribers at the time the research was conducted. Our measurement instrument was programmed into an online survey which was offered to every 20^{th} subscriber that entered the portal. The survey was online for three subsequent days in Spring 2000, and resulted in a sample size of 887 respondents.

The empirical test delivered the following results. In the first place, Entertainment Value is an equal partner to Usefulness, enjoying equally high or higher correlations with Website Usage. Second, Ease-of-Use does not seem to influence Website Usage directly, but indirectly through Usefulness. Likewise, Attractiveness does not appear to influence Website Usage directly, but indirectly through Entertainment value. The paper discusses these findings and considers the contributions and limitations of the extended TAM model for IS researchers.

1. Introduction

Many organisations today are trying to increase the number of visits to their website, as well as the frequency and duration of their visits once they get there. Consequently, a substantial number of business practitioners are showing more interest in the traffic from and to their websites. This may reflect a general concern for more return on investment, but may also be influenced by the advertising models of the intemet, which are more and more dependent on frequency and duration of visits (see e.g. Choi et al., 1997, Ch. 6, Hanson, 2000, p. 258).

However, attracting visitors to a website and generating repeat traffic have been argued to be the two main challenges for intemet marketeers (Hoffman et al., 1995). The generation of repeat traffic is probably the most difficult marketing challenge to achieve (Hoffman et al., 1995). Our research project builds upon prior research suggesting that the *features* of the website make a difference. Specifically, it aims to assist practitioners in determining whether and to what extent the site characteristics influence traffic.

From a scientific point of view, we aim to extend the Technology Acceptance Model (TAM) in order to broaden the application of this model to explain the use of websites. TAM (Davis, 1989), an adaptation of the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975; Taylor & Todd, 1995) is a well-established model to explain the use of information systems (both in terms of frequency and duration). So far, little research has been undertaken to examine whether these models also hold for websites (an exception being Chau et al., 2000). In particular, we argue that TAM has little attention for the presentation attractiveness and entertainment value of websites. Do “beauty” (attractiveness) and “fun” (entertainment value) matter? This research project extends TAM with the two “website” constructs and empirically validates the new model using structural equation modelling.

This paper is organised as follows. First, we present an overview of the model and discuss its hypotheses. We then describe the research method which was adopted to validate the model. Descriptive results, and an analysis of the structural equations follow research design. Subsequently, we give an interpration of

the findings and discuss the contributions and limitations of our work. Finally, we present the conclusions and discuss the implications for researchers and practitioners.

2. Theoretical foundations

Previous literature suggests that the intention to revisit a site is partly a function of website characteristics (e.g. Hoffman et al., 1995). There is also empirical evidence available that supports this claim. For instance, Lohse & Spiller (1999) found that poor interfaces and store navigation negatively influence number of shoppers and total sales online. In an empirical study on online buying behaviour, Li et al. (1999) found significant positive relationships between online buying behaviour and online channel characteristics such as interactivity. This suggests that website characteristics at least partly determine the frequency and duration of a website visit.

In this study we have adapted constructs from the stream of research on IT usage starting with Davis (Davis, 1989, Adams et al., 1992; Segars & Grover, 1993) and which is known as the Technology Acceptance Model (TAM). In short, TAM focuses on two constructs, perceived usefulness and perceived ease-of-use. These independent constructs influence the dependent variable "IT usage".

The dependent variable of this paper is Website Usage, a concept similar to the variable IT Usage in TAM and other IS research (see DeLone & McLean, 1992 for an overview). IT usage can be measured independent of the user, for instance by taking the product of the number (frequency) of logged revisits and the length of an average revisit. It is also possible to measure IT usage by having users self-report their perceptions on the number of visits and their length. This perception-based approach, which is consistent with other approaches to IT usage such as found in Taylor & Todd (1995) and Gelderman (1998), will be used in this paper.

We propose the TAM model be extended with two more constructs: perceived attractiveness and perceived entertainment value. The resulting model is depicted in Figure 1. The path codes refer to hypotheses which are discussed in more detail below.

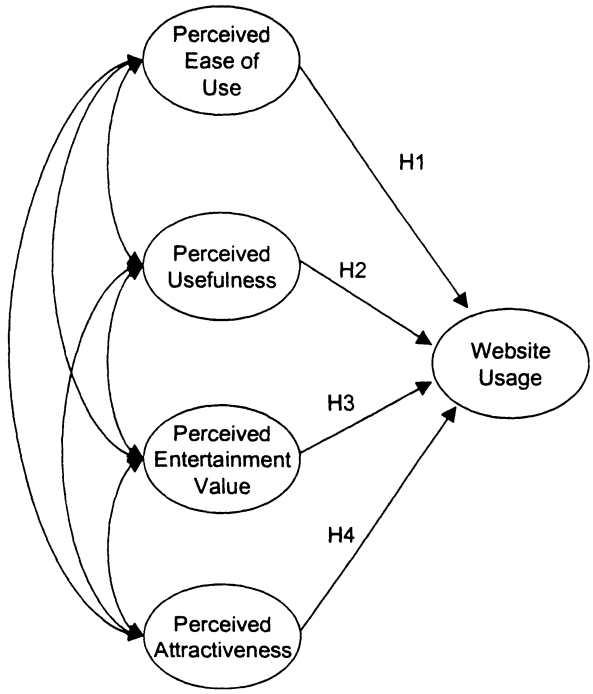

Figure 1 The impact of perceived website characteristics on website usage

2.2 *Perceived ease-of-use*

Perceived ease-of-use has been defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320), reflecting the notion that effort is a finite resource that a person will allocate to various activities. What matters to the user is the amount of effort that he or she will need to spend to navigate the system. Ease-of-use is a familiar concept that has received considerable attention, also in the user satisfaction stream of IS research (e.g. Doll & Torkzadeh, 1988) and recently in the e-commerce literature (e.g. Oinas-Kukkonen, 2000).

It is generally believed that all things equal, a system that is easier to use will increase intention to use as opposed to a system that is less easy to use (Davis, 1989; Taylor & Todd, 1995). It is also widely understood that this relationship holds for systems of a voluntary nature only (e.g. DeLone & McLean, 1992 and Gelderman, 1998). The straightforward argument considers individual effort to be a scarce resource, which an individual is supposed to be willing to allocate to more opportunities than he or she is able to do. Therefore, a system that requires less effort is perceived to be more favourable than a system which requires more effort (Davis, 1989). Therefore, we hypothesise:

HI. Perceived website ease-of-use positively influences website usage

2.3 Perceived usefulness

In line with TAM (Davis, 1989, p. 320), we redefine perceived usefulness as "the degree to which an individual believes that using the site will contribute to reaching a particular objective". Consistent with literature on information system usefulness (Davis, 1989; Adams et al., 1992; Taylor & Todd, 1995) we propose that increased usefulness is positively associated with the attitude towards a website. There is also some preliminary evidence that usefulness of a website leads to more use. In an empirical analysis of online shopping behaviour, Swaminathan et al. (1999) found that usefulness of vendor information significantly influenced the frequency of buying. This suggests that a useful site increases frequency of revisits.

H2. Perceived website usefulness positively influences website usage

2.4 Perceived entertainment value

Perceived entertainment value is defined in this paper as "the degree to which an individual is entertained by the site". Entertainment is increasingly being recognised by scholars as an important factor in website browsing behaviour. Hoffman & Novak (1996) mention and elaborate upon the concept, connecting it to the medium, rather than to a specific site. Eighmey & McCord (1998) develop the factor Entertainment Value in their exploratory application of gratification theory to website behavior. Huizingh (2000) specifies "entertainment" as a feature in his study on website capabilities.

The last hypothesis deals with the relationship between website entertainment value and attitude towards revisiting the website. As with attractiveness, we suggest this relationship to be positive, indicating that greater entertainment value will lead to more usage than websites with less entertainment value. A similar

relationship has also been suggested by Hoffman & Novak (1995) who argue that entertainment will lead to greater "flow", a psychological construct first developed by Csikszentmihalyi (1975). We hypothesise:

H3. Perceived website entertainment value positively influences website usage

2.5 *Perceived presentation attractiveness*

Perceived presentation attractiveness is defined as "the degree to which the user is attracted to the presentation of the website". Attractiveness is related to media vividness, which has been defined as "the representational richness of a mediated environment as defined by its formal features" (Hoffman & Novak, 1996). However, perceived attractiveness focuses on the aesthetic presentation of the data only. We propose that website presentation attractiveness is positively related to attitude towards the site. All things being equal, a user prefers to visit a more attractive site. This is a straightforward conjecture, but to our knowledge this determinant has not enjoyed any significant attention in the IS literature so far, and certainly has never been tested as such. We submit this is due to the often implicit assumption that information systems have to be "purposeful" rather than "fun" in their own right. As many intemet users will acknowledge, websites are not only purposeful or instrumental, but also entertaining and fun (see also Hoffman et al., 1995 on the recreational benefits of the Internet). It is this additional component that may well explain more of the variance in site attitude and revisit intention than the "traditional" constructs. Our hypothesis is:

H4. Perceived presentation attractiveness positively influences website usage

3. Research design

We sought to validate our theoretical model and the hypotheses discussed above through a survey of users of one particular website. This had the advantage that all respondents provided their opinions on the same base, and was similar to the testing approaches adopted by other TAM-scholars (for example Taylor &

Todd, 1995). The next sections discuss the website under study, the considerations with respect to the measurement instrument, and the sampling procedure.

Website

To validate our model we sought for a website that was both useful as well as entertaining. Portal sites usually combine both features, so we partnered with a Dutch portal site, that had over 300 000 subscribers at the time of research (Spring, 2000). The "usefulness" features of the portal site include: news, thematic information and links, a question and answer forum and a search engine facility. The "entertainment" features of the site include: online gaming, chat rooms and competitions.

Measurement instrument

In developing our measurement instrument for the model, we followed Dillman (2000)'s textbook on intemet-based survey design. A first requirement for the questionnaire was that the number of questions had to be limited. Some of our previous experience in web-based surveys suggested that the attention span of the average intemet user is very short. A lenghty survey would not contribute favourably to the overall response rate. In the second place, the portal company we participated with pressed us for brevity, so as not to compromise the image of the website.

To increase reliability, we aimed for structural equation modelling (see Bollen, 1989 for a detailed overview) to validate our model. One of the issues surrounding this technique is the infamous problem of "identification". As a rule of thumb, this problem can be avoided if one chooses at least three indicators per construct (see also Long, 1993; Hair et al., 1998). Following this rule of thumb, the model requires a measurement instrument of 5x3 = 15 items (questions). For usage, we set out with 4 items: the attitude towards using, the intention to use, the frequency of use and the intension of use.

Finally, for demographic purposes, we asked the population for their education, their age, and their sex. Eventually, our measurement instrument consisted of 19 questions. These can be found in Appendix 1 to this paper.

Sampling procedure

The survey was programmed by the technical department of the portal company according to our specifications. It was then distributed to every 20^{th} subscriber that entered the portal in Spring 2000. Through this approach, we aimed to ensure an aselect sampling of the total number of active subscribers.

4. Results

The final sample consisted of 887 individuals. Figure 2, 3, and 4 display the basic demographic variables of the sample.

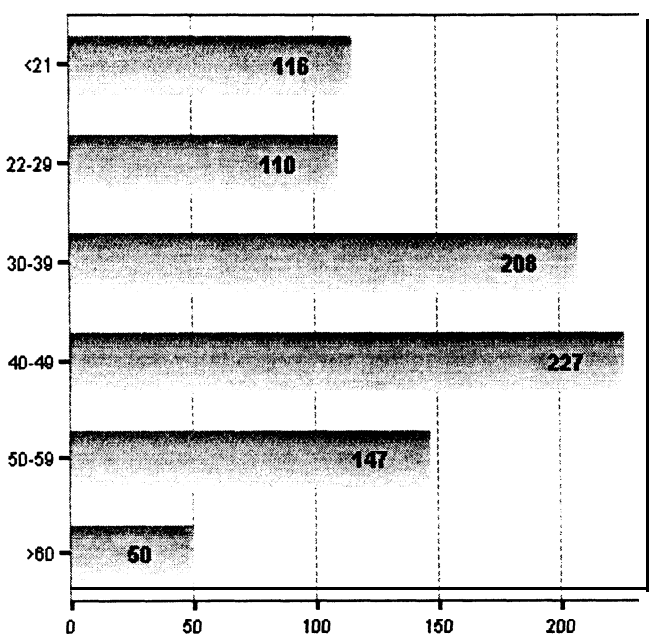

Figure 2 Age of the respondents (n = 887, 29 missing)

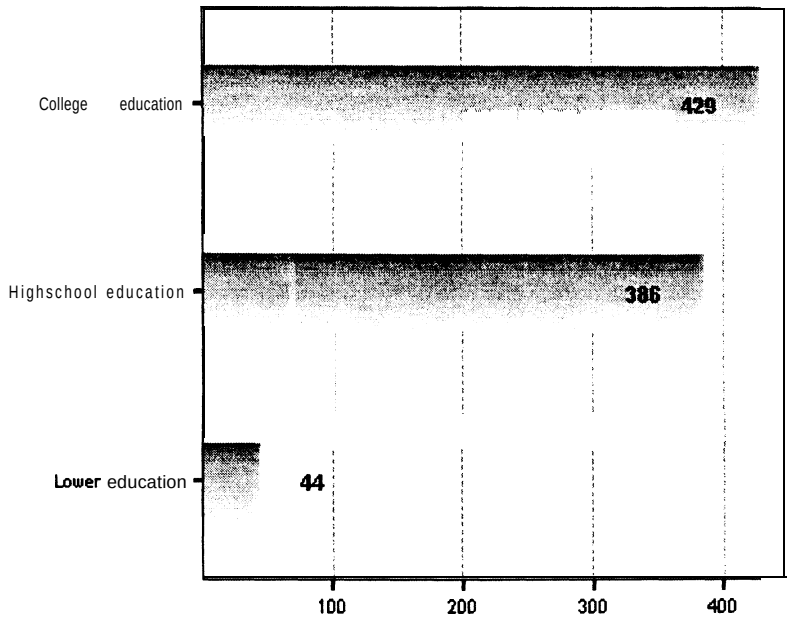

Figure 3 Education of the respondents (n = 887, 28 missing)

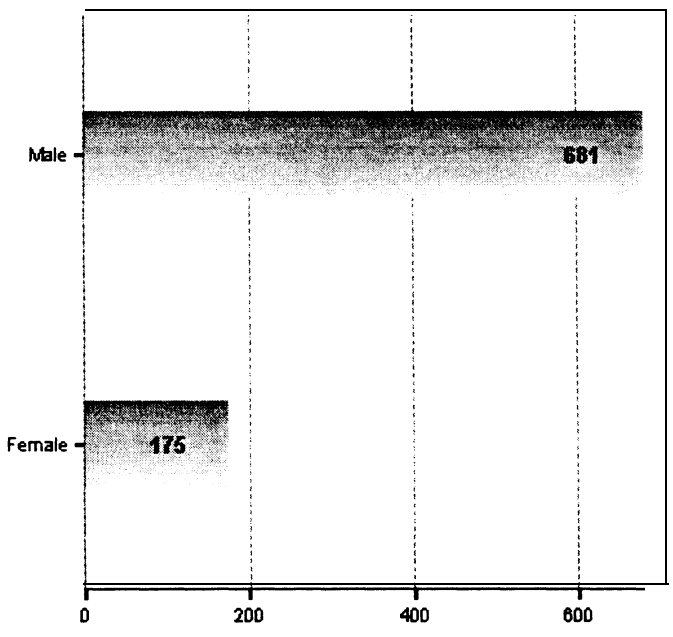

Figure 4 Sex of the respondents (n = 887, 31 missing)

without missing responses. This reduced our sample to 825 respondents. For replication purposes, the input covariance matrix is added as an appendix to this paper.

The values on generally accepted measures of fit are in Table 2. Throughout the paper, we use 0.05 as the threshold level for statistical significance.

Fit Measure	Norm (cf. Hair et al., 1998)	Default model
Discrepancy (^{2})	n/a	241,76
Degrees of freedom	n/a	80
P	Non-sign.	0,00
Discrepancy / df	<5	3,02
GFI	>0.90	0,96
Adjusted GFI	>0.90	0,95
Nor-n-red fit index	>0.90	0,96
Relative fit index	>0.90	0,95
Incremental fit index	>0.90	0,97
Tucker-Lewis index	>0.90	0,97
Comparative fit index	>0.90	0,97
RMSEA	co.05	0,05
RMSEA lower bound		0,04
RMSEA upper bound		0,06

Table 2 Fit measures for original model

Figure 5 below displays the estimated unstandardised path coefficients between the latent constructs and their estimated standard errors. All factor loadings by the manifest variables were highly significant at p = 0.000.

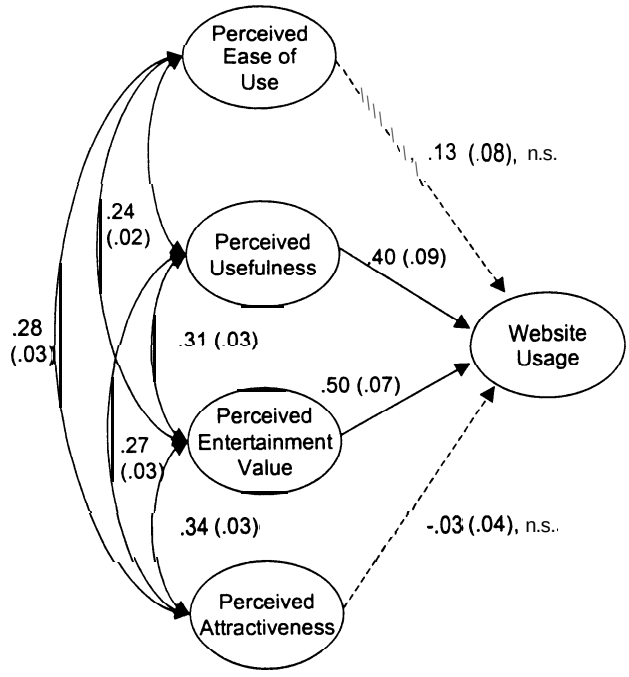

Figure 5 Unstandardised latent path coefficients (standard errors) for original model

The relationships between Perceived Usefulness, Perceived Entertainment Value and Website Revisit were significant, causing Hypotheses 2 and 3 to be accepted. However, the relationships between Ease of Use, Perceived Attractiveness and Website Usage were not significant, causing Hypotheses 1 and 4 to be rejected. The variance in Website Usage explained is 56%.

Because we were not able to find a significant direct effect of Attractiveness and Ease-of-Use on Website Revisit, we sought to respecify the model in order to see whether these independent variables had an indirect effect on Revisit, i.e. through a mediating variable. In particular, we specified a model where Ease of Use impacted Usefulness, and where Attractiveness impacted Entertainment Value (see Figure 5 below for the resultant path model).

The fit measures of the respecified model are given below.

Fit Measure	Default model

Discrepancy (^{2})	487,96
Degrees of freedom	85
P	0,00
Discrepancy / df	5,74
GFI	0,94
Adjusted GFI	0,91
Normed fit index	0,92
Relative fit index	0,90
Incremental fit index	0,93
Tucker-Lewis index	0,92
Comparative fit index	0,93
RMSEA	0,08
RMSEA lower bound	0,07
RMSEA upper bound	0,08

Table 3 Fit measures for revised model

Although the model has acceptable values on most measures of fit, it should be noted that this model fits the data worse than the original model. The ^{2} test adjusted for degrees of freedom performs worse, and so does the RMSEA. The RMSEA is within the acceptable level of 0.08 (Browne & Cudeck, 1993). Figure 5 below displays the estimated unstandardised path coefficients and the estimated standard errors for the revised model. Again, all factor loadings by the manifest variables were highly significant at p = 0.000.

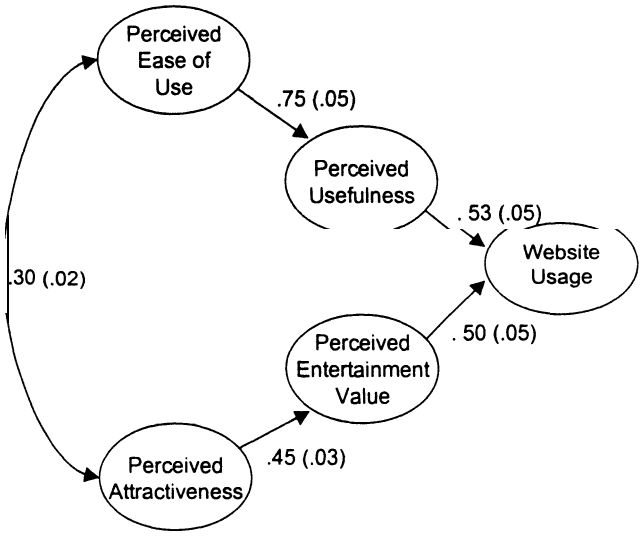

Figure 6 Unstandardised latent path coefficients (standard errors) of revised model

The estimated model supports the conjecture that Perceived Attractiveness does not directly impact usage, but indirectly through perceived Entertainment Value. Similarly, Perceived Ease of Use does not impact usage directly, but indirectly through Perceived Usefulness. The variance explained for Revisit, Usefulness, and Entertainment Value is 52%, 52%, and 33% respectively.

Discussion of findings

This study has delivered the following findings. In the first place, our research supports the extended version of TAM with respect to Entertainment Value, enjoying equally high correlations with Website Usage as Website Usefulness. Second, Ease-of-Use does not influence Website Usage directly, but indirectly through Usefulness. Likewise, Attractiveness does not influence Website Usage directly, but indirectly through Entertainment value. Each of these findings will now be discussed.

Our research suggests that *Perceived Website Usefulness and Perceived Entertainment Value are both important drivers of website usage.* Indeed, when the TAM model is applied to website contexts, Entertainment Value is an equal partner to Usefulness. The correlations between respondents that used the website and those that found the site useful and entertaining were relatively high.

We submit that perceived entertainment value is also important as it leads to longer visits (longer

duration) than usefulness. On a useful website, visitors quickly check the required information and surf elsewhere. For instance, traffic information, weather information are all examples of useful information that one does not typically stare at for long. However, games and competitions are not "useful" in the business sense of the word, but - as many web users will testify - certainly account for long visits. Indeed, the top 10 lists of average duration at a website (derived from statistics bureaus such as www.mediametrix.com) shows that visitors may spend up to two hours on sites with clear entertainment value (such as www.mplayer.com).

Our own research data also suggests that visitors who find the website generally entertaining also watch the site more intensely. The Pearson Correlation coefficient between Item 4 (Viewing intension of site) and Item 8 (Perceived overall entertainment value) was 0.39 ($p<0.01$), between Item 4 and Item 9 (Perceived overall usefulness value) was 0.3 1 ($p<0.01$).

The importance of Entertainment Value for websites has at least two research implications. In the first place, researchers are encouraged to further explore entertainment value and its antecendents and consequences. As discussed ealier, the concept has not enjoyed much theoretical and empirical attention in the IS research community. Possibly, this is due to the widespread presumption that information systems are meant to be "purposeful" rather than "fun". Fruitful theoretical directions to further explore entertainment value are likely to be available in the psychology literature (in particular "flow" theory, Csikszentmihalyi, 1975), and the mass media behaviour literature (in particular gratification theory, Eighmey & McCord, 1998).

In the second place, researchers are urged to examine the impact of entertainment value in TAM settings that do not apply to websites. For example, the E-mail and V-mail systems under study in previous research (Adams et al., 1992) are clearly examples of systems that are not only useful but also provide entertainment value. We are also reminded of Zuboff (1988)'s story where a gaming computer was installed at a non-cooperative factory workfloor to prepare employees for more "useful" computing later on. Intuitively, the factory management may have felt that more entertainment value would lead to increased acceptance. As a practical implication, it is conceivable that adding entertainment features to traditional information systems would contribute more to the usage of these systems in stead of adding usefulness features.

Our findings suggest that *Ease of Use does not directly impact website usage, but indirectly through Usefulness.* This is in line with newer versions of TAM (such as the one proposed by Venkatesh & Davis, 2000), where Usefulness is partly determined by Ease-of-Use. "Useful" websites need to provide their content in an easy to understand, accessible manner, and the less easy to use, the less useful the site will be perceived to be.

One explanation of the fact that we could not find a significant relationship between Ease-of-Use and Website Usage is that all respondents were "survivalists". All respondents who were able to finish the web surveys had "survived" the website user interface to some extent. Consequently, all respondents may generally respond more favourably towards ease of use compared to the group of non-survivors. This may have caused the insignificant variation between ease-of-use and usage. The means and standard deviations of the three Ease-of-use questions are 3.56 (0.85), 3.31 (0.95), 3.59 (0.89) respectively. While these judgments are not overly positive, non-survivors may rate the ease-of-use even worse. Future research will have to pay attention to these non-survivors, perhaps by using late respondents (from a second or third reminder) as proxies.

Our findings suggest that *Attractiveness does not directly contribute to website usage, but indirectly through Entertainment Value.* We could not find a significant correlation between respondents that appreciated the lay-out and the colours of the site and high website usage. Respondents that did not like the site showed high usage as well, and respondents that did like the site also accounted for low usage. An explanation for the insignificant links between Attractiveness, Ease-of-Use and Usage may be that their relationships are not linear. It is conceivable that Attractiveness and Ease-of-Use are to a certain extent hygiene factors, or preconditions for website usage. Once they reach acceptable levels in the eyes of the web visitor, they do no longer influence website usage.

We conclude that Usefulness and Entertainment Value are the first-order drivers, and Ease-of-Use and Attractiveness second-order ones. An implication of this finding is that antecedents of entertainment and usefulness deserve more attention. There may be more than the two we have identified through respecification. As an example of a third driver, it is possible that the sense of being part of a community (such as the book-reading community at Amazon.com) contributes favourably to Entertainment Value. Visitors may find it entertaining to read and experience the opinions of others on the subject that binds the

community. It should be noted that community websites may also be purposeful in the sense that other community members may advise the website visitor on certain decisions. Clearly, the impact of communities on website usage involves subtle relationships through Entertainment Value as well as Usefullness. We encourage researchers to look further into this matter.

Conclusions

We believe the Technology Acceptance Model is a suitable model for explaining website usage, provided it is extended with the constructs developed and validated above. Our research confirms that Usefulness and Entertainment Value are the primary drivers for website usage. Ease-of-Use significantly influences Usefulness, and Presentation Attractiveness significantly influences Entertainment Value. We have also demonstrated that "Beauty matters": nice colours and lay-out drive entertainment value, which in turn drives website usage.

Our work is subject to a number of limitations. In the first place, we have investigated only one website, one that had both useful features as well as entertainment features. We did not link the perceptions to features directly, so as to "weight" the perception scores during the analysis. By doing so, we did not address the fact that on a primarily useful site, the "usefulness" scores presumably have a greater impact on website usage than the "entertainment" scores. Further research is necessary to operationalise the link between the features and their perceptions more clearly and see whether the relationships hold under those circumstances.

Second, our model arised because of respecification of the model against the original data. Respecification should be read in the light of theory building, not theory testing. Our original model was not fully supported, and so the new model will need to be retested against new data. Further research will need to validate the revised model.

Despite these limitations, we believe we have contributed to the rising body of knowledge concerning the determinants of website usage. Many companies today are trying to increase the amount of traffic and with the theoretical framework that has been developed in this paper they can structure their website development work and analyze their traffic statistics. However, the framework is just a first step and

further research is needed to “flesh it out” with more antecedents. We believe this is an interesting challenge to take up for information systems researchers and marketing researchers alike.

Acknowledgements

The author would like to thank the technical department, the chief editor and the management of the portal company for their cooperation during this study.

Appendix 1 ı Survey instrument

Thank you for participating in this survey about website X.

Below you will find a number of statements about website X. Can you specify to what degree you agree or disagree with these statements?

Usage

1. I am positive towards website X | Wholly disagree (5 options) Wholly agree'
2. I intend to visit website X frequently | Wholly disagree (5 options) Wholly agree
3. How often do you visit website X? | Hardly or Never | (5 options) | Very often
4. How intensive do you watch the site? | Very shallow | (5 options) | Very intentsive

Ease-of-Use

5. It is easy to navigate around the site | Wholly disagree (5 options) Wholly agree
6. I can quickly find the information that I need | Wholly disagree (5 options) Wholly agree
7. I think it is a user-friendly site | Wholly disagree (5 options) Wholly agree

Content | Usefulness

8. I find website X primarily a useful site | Wholly disagree (5 options) Wholly agree
9. The information on the site is interesting to me | Wholly disagree (5 options) Wholly agree
10. I find this a site that adds value | Wholly disagree (5 options) Wholly agree

Content | Entertainment value

11. I find website X primarily an entertaining site | Wholly disagree (5 options) Wholly agree

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[1] Item dropped for Structural Equation Modelling analysis

12. I browse the site for pleasure | Wholly disagree (5 options) Wholly agree

13. Browsing website X is an agreeable way of passing time Wholly disagree (5 options) Wholly agree

Presentation attractiveness

14. Overall, I find that the site looks attractive | Wholly disagree (5 options) Wholly agree

15. The lay-out of the site is attractive | Wholly disagree (5 options) Wholly agree

16. The colours that are used on the site are attractive | Wholly disagree (5 options) Wholly agree

Some data about yourself:

Your age: <21 / 22-29 / 30-39 / 40-49 / 50-59 / 60>

Your highest level of education: <3 levels of education according to the Dutch education system>

Are you: male / female?

Thank you for your cooperation!

Appendix 2: Covariance matrix

	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Q2	0,832														
Q3	0,525	1,050													
Q4	0,341	0,506	1,077												
Q5	0,252	0,238	0,224	0,717											
Q6	0,283	0,271	0,232	0,477	0,893										
Q7	0,313	0,297	0,258	0,417	0,527	0,785									
Q8	0,322	0,383	0,369	0,208	0,276	0,328	0,824								
Q9	0,309	0,310	0,277	0,246	0,361	0,341	0,331	0,767							
Q10	0,328	0,399	0,371	0,214	0,286	0,346	0,518	0,280	1,015						
Q11	0,325	0,401	0,398	0,258	0,309	0,352	0,510	0,343	0,605	0,861					
Q12	0,331	0,371	0,399	0,269	0,384	0,361	0,372	0,413	0,399	0,451	0,787				
Q13	0,335	0,372	0,336	0,280	0,404	0,384	0,376	0,490	0,348	0,416	0,554	0,796			
Q14	0,272	0,278	0,248	0,301	0,299	0,363	0,400	0,266	0,361	0,360	0,325	0,350	0,949		
Q15	0,271	0,249	0,234	0,292	0,294	0,371	0,365	0,266	0,370	0,338	0,331	0,332	0,793	0,959	
Q16	0,188	0,186	0,167	0,188	0,167	0,151	0,256	0,132	0,268	0,270	0,199	0,210	0,490	0,512	1,012

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